Advanced Durable Flexible Ultra Low Outgassing Thermal Control Coatings for NASA Science Missions, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

This Phase I program proposes to synthesize novel nanoengineered ultra low out gassing elastomers and formulate high temperature capable flexible thermal control coatings as well as adhesives based on the proposed chemistries that are stable in various space environments. We have envisioned nano-engineered clusters and the innovative synthesis of the poly carborane-polysiloxanes, to surpass the performance of the current state of the art and provide the formulations that are space environment stable and can provide radiation hardening and enhanced life long survivability for science mission hardware in space environments. We propose to investigate: (1) Synthesis of high molecular weight ultra low outgassing poly-carborane-siloxanes that are stable and demonstrate for temperatures ≥ 500□C. (2) Use of nano-engineered clusters with appropriate cross linker chemistries for tailoring secondary emission properties while providing protection from the irradiation using electron donor compounds. This can help us to employ electron on demand strategy to mitigate the secondary and sustained arcs. (3) Investigations in to: thermal stability thermally induced out-gassing studies, ESD behavior, and space environment simulation of elastomers for the typical GEO and LEO scenarios. These results from this study will guide us to select the promising formulations for the scale up and validation studies in Phase II. Lastly, we have proposed investigations in Boron Nitride Self Assembled Nano Cluster Mesh (BN-SANCs

TM

), which may totally change the way we formulate the space stable thermal control material systems for all earth orbits and planetary environment, along with its use in radiation shielding with use of 10BN-SANCs

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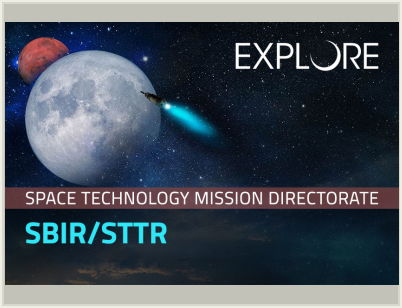
Anticipated Benefits

Potential NASA Commercial Applications: The commercial industry has planned several satellites for the broad band communication activities. The transportation authorities are also contemplating commercial space based radars for air traffic control. These planned candidate optimal fleet designs may call for putting assets in the mid-earth orbits (MEO) which require radiation stability along with the high temperature capability. Currently no polymeric ultra low out grassing elastomers and thermal control coating exist that can withstand the exposure to the high temperatures & space environments of the interest of exploration science missions. This program attempts to fill this gap. Many other commercial as well as the DOD platform hardware can also benefit form the fulfillment of this technology gap. Even the partial success in dielectric engineering of the resultant polymeric adhesive may improve our ability to provide materials that can employ electrons on



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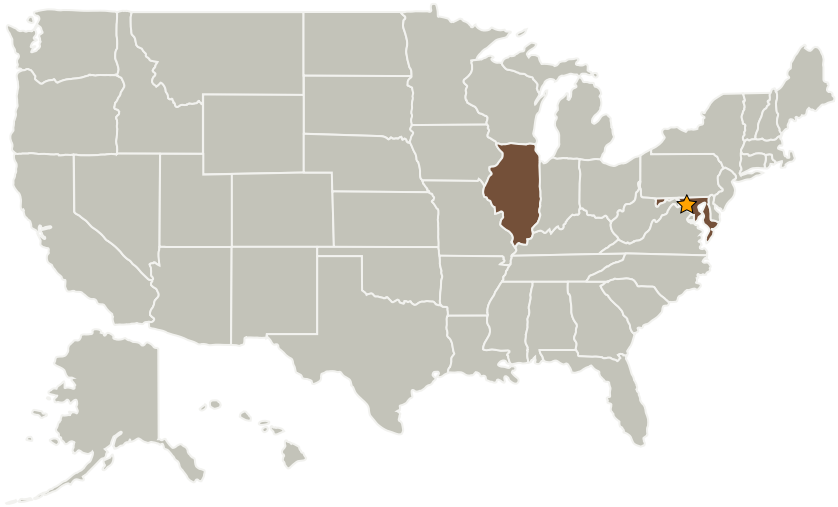
demand concept, which can aid as a tool to mitigate the secondary arc and sustained arc issues on space power bus hardware. Thus, the return on investments can be sizable and multifaceted because of this program. The success in Boron Nitride Nano Cluster Mesh (BN-SANCs

TM

) concept will provide a platform technology to launch various commercial semi conducting product applications and radiation shielding concepts.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Applied Material Systems Engineering, Inc. (AMSENG)	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Schaumburg, Illinois

Primary U.S. Work Locations	
Illinois	Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

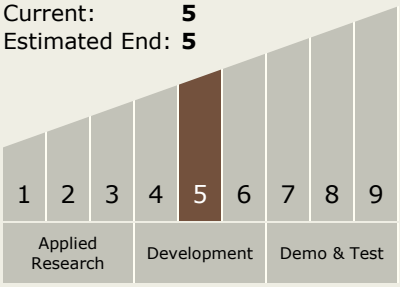
Carlos Torrez

Principal Investigator:

Mukund S Deshpande

Technology Maturity (TRL)

Start: **5**
Current: **5**
Estimated End: **5**



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Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Advanced Durable Flexible Ultra Low Outgassing Thermal Control Coatings for NASA Science Missions, Phase I Project Image

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.3 Heat Rejection and Storage